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Japanese (PDF) | File Wrapper Information

FULL CONTENTS CLAIM + DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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Notes:
1. Untranslatable words are replaced with asterisks (****).
2. Texts in the figures are not translated and shown as it is.

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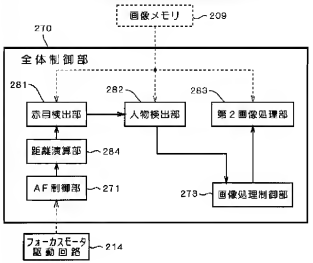
FULL CONTENTS

[Claim(s)]
[Claim 1]An image processing device comprising:
The 1st picture photoed to the same photographic subject without emitting light in a flash.
A bloodshot-eyes area detection means which detects a bloodshot-eyes field in said 2nd picture using the 2nd picture photoed by emitting light in a flash, and a figure area detection means to detect a beige field near said bloodshot-eyes field in said 2nd picture as a figure area.

[Claim 2]The image processing device comprising according to claim 1:
A candidate area extraction means to extract a bloodshot-eyes candidate area where said bloodshot-eyes area detection means serves as a candidate of said bloodshot-eyes field of said 1st picture and each of said 2nd picture.
A candidate area comparison means which makes a bloodshot-eyes candidate area which compares a bloodshot-eyes candidate area of said 1st picture with a bloodshot-eyes candidate area of said 2nd picture, and is only in said 2nd picture said bloodshot-eyes field.

[Claim 3]In the image processing device according to claim 2, [said bloodshot-eyes area detection means] An image processing device having further an incidence calculating means which computes bloodshot-eyes incidence which a bloodshot-eyes phenomenon of said photographic subject generates, and a criterion alteration means which changes a criterion for said candidate area extraction means to extract said bloodshot-eyes candidate area according to said bloodshot-eyes incidence.
[Claim 4]An imaging means which picturizes said photographic subject in the image processing device according to any one of claims 1 to 3, An image processing device having further an image processing condition setting means to set up conditions of Image Processing Division, and/or image pick-up conditions of said imaging means based on said figure area detected by said figure area detection means.

Drawing selection: Representative draw



[Translation done.]

[Claim 5]An image processing method comprising:
The 1st picture photoed to the same photographic subject without emitting light in a flash.
A bloodshot-eyes field detection process which detects a bloodshot-eyes field in said 2nd picture using the 2nd picture photoed by emitting light in a flash, and a figure area detection process which detects a beige field near said bloodshot-eyes field in said 2nd picture as a figure area.

[Claim 6]A program characterized by comprising the following for making it function as an image processing device.
The 1st picture photoed without emitting [computer] light in a flash to the same photographic subject.
A bloodshot-eyes area detection means which detects a bloodshot-eyes field in said 2nd picture using the 2nd picture photoed by emitting light in a flash, and a figure area detection means to detect a beige field near said bloodshot-eyes field in said 2nd picture as a figure area.

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the art of detecting the person in a picture.
[0002]
[Description of the Prior Art]Conventionally, [by taking a photograph with a digital still camera (henceforth a "digital camera") etc.] Or it processes to the digital image acquired by capturing the outputted image with a scanner etc., and the art of detecting the person in the picture used as a main object is proposed.
[0003]The field (henceforth a "beige field") approximated to the color of the skin of the human being in a picture as general art of detecting the person in a picture is extracted, and processing in which the beige field concerned is detected as a person's field (henceforth a "figure area") is known. However, there is a possibility that even the object and building in which having extracted the beige field simply in this way has a near color beige to a picture may be detected as a figure area.
[0004]In order to correspond to this, shape judging processing whether the shape of the extracted beige field bears a close resemblance [shape /, such as a person's face,] is performed, and only when it resembles closely, the art of detecting the beige field concerned as a figure area is known.
[0005]If it is a picture at the time of flash luminescence, it will assume that a bloodshot-eyes phenomenon occurs in a main object (person), a red field is detected from the inside of the extracted beige field, and if a red field exists, the art of detecting the beige field concerned as a figure area is known.
[0006]
[Problem to be solved by the invention]However, when performing a shape judging as mentioned above, since it becomes complicated processing, there is a problem of requiring great processing time. Especially the thing for which the request of shortening of image processing time applies such shape judging processing in a strong digital camera etc. is difficult.
[0007]When detecting a red field as mentioned above, when a red illumination light source etc. were in the field of the building which has a near color beige, for example, it might detect as a figure area to the field of the building concerned, and a figure area was not necessarily able to be detected in sufficient accuracy.
[0008]In light of the above-mentioned problems, this invention is a thing.
The purpose is providing the art only a figure area being detectable out of a picture, realizing processing speed of **.

[0009]
[Means for solving problem]In order to solve the above-mentioned technical problem, [the invention of Claim 1] The 1st picture that was an image processing

device, and was photoed to the same photographic subject without emitting light in a flash, It has the bloodshot-eyes area detection means which detects the bloodshot-eyes field in said 2nd picture, and a figure area detection means to detect the beige field near said bloodshot-eyes field in said 2nd picture as a figure area, using the 2nd picture photoed by emitting light in the flash.

[0010]In the image processing device according to claim 1, the invention of Claim 2, [said bloodshot-eyes area detection means] A candidate area extraction means to extract the bloodshot-eyes candidate area which serves as a candidate of said bloodshot-eyes field of said 1st picture and each of said 2nd picture, The bloodshot-eyes candidate area of said 1st picture is compared with the bloodshot-eyes candidate area of said 2nd picture, and it has the candidate area comparison means which makes the bloodshot-eyes candidate area only in said 2nd picture said bloodshot-eyes field.

[0011]In the image processing device according to claim 2, the invention of Claim 3, [said bloodshot-eyes area detection means] It has further the incidence calculating means which computes the bloodshot-eyes incidence which the bloodshot-eyes phenomenon of said photographic subject generates, and the criterion alteration means which changes a criterion for said candidate area extraction means to extract said bloodshot-eyes candidate area according to said bloodshot-eyes incidence.

[0012]In the image processing device according to any one of claims 1 to 3, [the invention of Claim 4] It has further the imaging means which picturizes said photographic subject, and an image processing condition setting means to set up the conditions of Image Processing Division, and/or the image pick-up conditions of said imaging means based on said figure area detected by said figure area detection means.

[0013]The invention of Claim 5 is an image processing method, and receives the same photographic subject, The bloodshot-eyes field detection process which detects the bloodshot-eyes field in said 2nd picture using the 1st picture photoed without emitting light in a flash, and the 2nd picture photoed by emitting light in the flash, It has the figure area detection process which detects the beige field near said bloodshot-eyes field in said 2nd picture as a figure area.

[0014]The invention of Claim 6 is a program and receives the same photographic subject in a computer, The bloodshot-eyes area detection means which detects the bloodshot-eyes field in said 2nd picture using the 1st picture photoed without emitting light in a flash, and the 2nd picture photoed by emitting light in the flash, It is made to function as an image processing device provided with a figure area detection means to detect the beige field near said bloodshot-eyes field in said 2nd picture as a figure area.

[0015]

[Mode for carrying out the invention]Hereafter, an embodiment of the invention is described, referring to Drawings.

[0016]<1. 1st embodiment> <composition of 1-1. digital camera> drawing 1 thru/or drawing 3 are the figures showing an example of the aspect composition of the digital camera 1 which is an image processing device which acquires a picture as digital data, and drawing 1 is [a rear elevation and drawing 3 of a front view and drawing 2] bottom views. As shown in drawing 1, the digital camera 1 comprises the box type camera body part 2 and the image pick-up part 3 of rectangular parallelepiped shape.

[0017]While the zoom lens 301 with a macro function which is a taking lens is formed, the modulated light sensor 305 which receives the reflected light of the flash light from a photographic subject as well as a silver salt lens shutter camera is formed in the front side of the image pick-up part 3.

[0018]The shutter button 8 is formed in a left edge part at the front side of the camera body part 2, and is provided in the grip part 4 and the top center at the internal flash 5 and upper surface side. The shutter buttons 8 are 2 stage switches which can detect a half pressed state (S1) which is adopted with the film-based camera, and a full-press state (S2).

[0019]On the other hand, as shown in drawing 2, the liquid crystal display (LCD:

Liquid Crystal Display) 10 for performing the monitor display of an image shot, the reproduction display of a recorded image, etc. is formed in the approximately center at the back side of the camera body part 2. The key switch groups 221-226 and the electric power switch 227 of LCD10 which operate the digital camera 1 caudad are provided.

[0020]The operation changeover switch 14 which changes the operational mode of a camera between "photography" and "reproduction" is formed in the back side of the camera body part 2. If it is supposed that it is possible to take a photograph if operational mode is set as "photography", and to generate the picture about a photographic subject and operational mode is set as "reproduction", the picture recorded on the memory card will be read and LCD10 will be reproduced. The operation changeover switch 14 is a slide switch of two points of contact, if a slide set is carried out in a lower part position, operational mode will be "photoed", and operational mode will be "reproduced" if a slide set is carried out in an upper position.

[0021]It is possible for 4 ** switch 230 to be formed in camera back right-hand side, and to perform various operations. For example, when operational mode is "photography", a change of zooming magnification is made by pushing the button 231,232.

[0022]As shown in drawing 2, the electronic view finder (EVF:Electric View Finder) 31 is formed in the back of the image pick-up part 3. The display of a photographic subject is electronically possible for EVF31 via an ocular. The photography person can take a photograph, checking a photographic subject by either LCD10 or EVF31.

[0023]The person detection mode change button 322 is formed in the lower part of EVF31 with the LCD button 321 for making LCD10 turn on and off. The person detection mode which performs the usual photography by standard control and which usually detects the person in a picture with photography mode is contained in the photography mode of the digital camera 1. It is possible to usually change photography mode and person detection mode for photography mode by ****** which pushes the person detection mode change button 322.

[0024]As shown in drawing 3, the card slot 17 is formed in the bottom of the camera body part 2. The card slot 17 can load with the memory card 91 grade in which the attachment and detachment for recording the picture etc. which were photoed are free.

[0025]<The internal configuration of a 1-2. digital camera>, next the internal configuration of the digital camera 1 are explained. Drawing 4 is a figure showing the outline of arrangement of each composition in the image pick-up part 3. Drawing 5 is a block diagram showing the composition of the digital camera 1.

[0026]As shown in drawing 4, the image pick-up circuit provided with CCD303 is established in the proper place of the back position of the zoom lens 301 in the image pick-up part 3. Inside the image pick-up part 3, change and the accomodated location of the zoom ratio of the zoom lens 301, In order to perform the zoom motor M1 for performing lens migration between image pickup positions, and adjustment of a focus. The iris diaphragm motor M3 for [which extracts and adjusts the opening diameter of 302] having been provided in the focal motor M2 and the zoom lens 301 to which the focus lens 311 in the zoom lens 301 is moved is formed.

[0027]As shown in drawing 5, the zoom motor M1, the focal motor M2, and the iris diaphragm motor M3 are driven, respectively by the zoom motor drive circuit 215, the focal motor drive circuit 214, and the iris diaphragm motor drive circuit 216 which were established in the camera body part 2. Each drive circuits 214-216 drive each motors M1-M3 based on the control signal given from the whole control part 270 of the camera body part 2.

[0028]With the zoom lens 301, CCD303 carries out photoelectric conversion of the light figure of the photographic subject by which image formation was carried out to the picture signal (signal which consists of a signal sequence of the pixel signal received by each pixel) of the color component of R (red), G (green), and B (blue), and outputs it.

[0029]The timing generator 314 generates the driving control signal of CCD303 based on the reference clock transmitted from the timing control circuit 202 of the camera body part 2. The timing generator 314 generates clock signals, such as read control signals (a horizontal synchronization signal, a vertical synchronizing signal, a transmission signal, etc.) of the timing signal of an integration start / termination (an exposure start / termination), and the euphotic signal of each pixel, and outputs them to CCD303, for example.
[0030]The signal conditioning circuit 313 performs predetermined analog signal processing to the picture signal (analog signal) outputted from CCD303. The signal conditioning circuit 313 has a CDS (correlation double sampling) circuit and an AGC (auto gain control) circuit, reduces the noise of a picture signal by a CDS circuit, and performs level adjustment of a picture signal by adjusting a gain in an AGC circuit.
[0031]The light control circuit 304 controls the emission quantity of the internal flash 5 in flash photographs to the predetermined emission quantity set up by the whole control part 270. If the reflected light of the flash light from a photographic subject is received by the modulated light sensor 305 simultaneously with an exposure start at the time of flash photographs and this light income reaches predetermined emission quantity, a luminescence stop signal will be outputted from the light control circuit 304. A luminescence stop signal is led to the flash control circuit 217 via the whole control part 270 provided in the camera body part 2, The flash control circuit 217 answers this luminescence stop signal, luminescence of the internal flash 5 is stopped compulsorily, and, thereby, the emission quantity of the internal flash 5 is controlled by predetermined emission quantity.
[0032]In the camera body part 2, A-D converter 205 changes the signal of each pixel of a picture into a 10-bit digital signal (A/D conversion). A-D converter 205 changes each pixel signal (analog signal) into a digital signal based on the reference clock for A/D conversions inputted from the timing control circuit 202.
[0033]The timing control circuit 202 is constituted so that the clock to a reference clock, the timing generator 314, and A-D converter 205 may be generated. The timing control circuit 202 is controlled by the whole control part 270.
[0034]The digital signal changed by A-D converter 205 is inputted into the 1st image processing portion 240 and the whole control part 270, respectively. In the 1st image processing portion 240, various Image Processing Division is performed, it memorizes as an image shot to the memory card 91, or the digital signal inputted into the 1st image processing portion 240 is used as a live view display image. On the other hand, the digital signal inputted into the whole control part 270 is used in order that the whole control part 270 may calculate the brightness of a photographic subject, contrast, color balance, etc.
[0035]As opposed to the picture which the 1st image processing portion 240 is realized, for example as an IC (Integrated Circuit) of one chip, and was made into the digital signal by A-D converter 205, Two or more kinds of Image Processing Division, such as black-level-correction processing, white-balance-correction processing, a gamma correction process, and pixel interpolation processing, is performed. The contents of processing of these Image Processing Division are set up by the whole control part 270 for every picture. For example, about white-balance-correction processing, the white balance adjustment value set up for every picture from the whole control part 270 is inputted. Interpolation of a lacuna color pixel will be performed by pixel interpolation processing of the 1st image processing portion 240, and each picture element data of a picture will have data of 3 colors of RGB(s).
[0036]The image memory 209 is a memory which memorizes the data of the picture outputted from the 1st image processing portion 240. The image memory 209 has the capacity which can memorize the picture for at least two frames.
[0037]VRAM(video RAM)210 is a buffer memory of the picture by which it is indicated by reproduction LCD10. VRAM211 is a buffer memory of the picture displayed on EVF31. VRAM210 has a storage capacity with possible VRAM211 storing the image data corresponding to the number of pixels of EVF31 for the

image data corresponding to the number of pixels of LCD10, respectively.
[0038]In the photography waiting state at the time of operational mode being "photography", a picture is photoed by the image pick-up part 3 every [1/] 30 seconds, and it is changed into a digital signal by A-D converter 205. And after predetermined signal conditioning is performed by the 1st image processing portion 240, while storing temporarily at the image memory 209, it is transmitted to VRAM210 and 210 via the whole control part 270, and is displayed on LCD10 and EVF20 (live view display). By this, the user can recognize an object image visually.
[0039]When operational mode is "reproduction", after signal conditioning predetermined in the picture read from the memory card 91 is performed by the whole control part 270, it is transmitted to LCDVRAM210 and indicated by reproduction LCD10. The display also with EVF20 [same] is performed.
[0040]The card interface 212 is Interface Division for performing the writing and read-out of a picture to the memory card 91 via the card slot 17.
[0041]The flash control circuit 217 is a circuit which controls luminescence of the internal flash 5, and while making the internal flash 5 emit light based on the control signal from the whole control part 270, luminescence of the internal flash 5 is stopped based on a luminescence stop signal as stated above.
[0042]The information by which an operational input is carried out is transmitted to the whole control part 270 by the user via the control unit 250 by the control unit 250 including the various switches and button which were mentioned above.
[0043]The whole control part 270 comprises a microcomputer provided with CPU, and carries out centralized control of a photographing function and the regenerative function. ROM261 the control program for processing the picture which controlled the drive of each member which the digital camera 1 mentioned above, or was acquired was remembered to be, and RAM262 used as the workspace for doing much operation work according to a control program are electrically connected to the whole control part 270. The program data currently recorded on the memory card 91 which is a recording medium can be read via the card interface 212, and it can store in ROM261. That is, a control program can be installed into the digital camera 1 from the memory card 91.
[0044]In drawing 5, the AF control part 271, the exposure controller 272, the image processing control part 273, and the image recording section 274 show the function realized when operation processing is carried out by CPU of the whole control part 270, etc. according to the control program memorized by ROM261.
[0045]The AF control part 271 performs what is called AF (auto-focusing) control. The AF control part 271 evaluates the contrast of the picture signal inputted from A-D converter 205, and makes the position of the focus lens 311 drive so that this contrast may become the highest. Thereby, the position of the image formed by the zoom lens 301 is in agreement with the imaging surface of CCD303.
[0046]The exposure controller 272 performs setup of an exposure condition, and exposure control. The brightness of a photographic subject is specifically computed from the picture signal inputted from A-D converter 205, and an iris diaphragm value and shutter speed (correctly charge storage time of CCD303) are set up. When a suitable light exposure is not obtained by adjustment with an iris diaphragm value and shutter speed, either, a setup which makes the internal flash 5 emit light is performed. According to the set-up exposure condition, a control signal is transmitted to the timing control circuit 202, the iris diaphragm motor drive circuit 216, and the flash control circuit 217, and exposure control is performed.
[0047]The image processing control part 273 sets up the image processing condition about the 1st image processing portion 240 that performs Image Processing Division to the picture outputted from A-D converter 205, and the 2nd image processing portion 283 (refer to drawing 6) that performs Image Processing Division by software to the picture memorized by the image memory 209. For example, the color balance of the picture signal inputted from A-D converter 205 is computed, and a white balance adjustment value is set up according to the computed color balance.

[0048]If photography is directed by the shutter button 8 when operational mode is "photography", [the image recording section 274] The compressed picture compressed with the JPEG system by the compressibility by which the setting input was carried out from the switch included in the thumbnail picture and the control unit 250 of the picture captured into the image memory 209 is generated, Both images are memorized to the memory card 91 with the tag information (information, including a top number, an exposure value, shutter speed, compressibility, a photographing day, the data of turning on and off of the flash at the time of photography, object distance, scene information, etc.) about an image shot.

[0049]<Operation of a 1-3. digital camera> and also the whole control part 270 perform person detection processing which detects the figure area in a picture at the time of photography, when photography mode is person detection mode. Drawing 6 is a block diagram showing the function of the digital camera 1 concerning person detection processing. In drawing 6, the bloodshot-eyes detecting element 281, the person detection part 282, the 2nd image processing portion 283, and the distance operation part 284 show the function realized when operation processing is carried out by CPU of the whole control part 270, etc. according to the control program memorized by ROM261.

[0050]The bloodshot-eyes detecting element 281 detects the bloodshot-eyes field in the picture memorized by the image memory 209. When detecting a bloodshot-eyes field, the 1st picture (henceforth a "non-flash luminescence picture") photoed without emitting light in the internal flash 5, and the 2nd picture (henceforth a "flash luminescence picture") photoed by emitting light in the flash are used.

[0051]The person detection part 282 detects the beige field near the bloodshot-eyes field detected by the bloodshot-eyes detecting element 281 as a figure area in a picture. The 2nd image processing portion 283 realizes Image Processing Division, such as amendment etc. of the bloodshot-eyes field in the detected picture, by software. The distance operation part 284 acquires the position information in which the focus lens 311 focuses from the AF control part 271, and computes the distance from the position information concerned to a main object (person) as object distance.

[0052]Drawing 7 is a block diagram showing the functional constitution of the bloodshot-eyes detecting element 281. The incidence rate calculation part 291 computes the probability that the bloodshot-eyes phenomenon of the photographic subject in a picture will occur, as bloodshot-eyes incidence. The candidate area extraction part 293 extracts a red field using the pixel value of a non-flash image and each flash image as a field (henceforth a "bloodshot-eyes candidate area") which serves as a candidate of a bloodshot-eyes field. The criterion changing part 292 changes a criterion for the candidate area extraction part 293 to extract a bloodshot-eyes candidate area according to the bloodshot-eyes incidence computed by the incidence rate calculation part 291. The candidate area comparing element 294 compares a bloodshot-eyes candidate area with a flash image with a non-flash image, and detects the bloodshot-eyes candidate area only in a flash image as a bloodshot-eyes field. The details of these functions are mentioned later.

[0053]Drawing 8 and drawing 9 are the figures showing the flow of the operation at the time of photography of the digital camera 1 in person detection mode. Hereafter, with reference to drawing 6 thru/or drawing 9, the photographing operation in the person detection mode of the digital camera 1 is explained.

[0054]first, the shutter button 8 half-presses (S1 state) -- having (step ST11) -- the preparation for picture photography is made. That is, the focus lens 311 drives by the AF control part 271, and the position of the image formed by the zoom lens 301 is in agreement with the imaging surface of CCD303. (Step ST12).

[0055]Next, the exposure controller 272 sets up an exposure condition based on the brightness of a photographic subject. That is, a setup of a (nonluminescent setup) is made [whether it is emitting light in an iris diaphragm value, shutter speed, and the internal flash 5 (luminescence setup), and] (step ST13). The image processing control part 273 sets up a white balance adjustment value based on the color balance of a photographic subject (step ST14).

[0056]Release permission is made after the preparation for photography is completed as mentioned above. Namely, the lock of the shutter button 8 separates and it will be in the state which can be pressed fully (S2 state) (step ST15). When predetermined time operation of the shutter button 8 is not carried out in this state (it is No at step ST16), it will return to step ST11. On the other hand, when the shutter button 8 is pressed fully (it is Yes at step ST16), it progresses to step ST21 of drawing 9.

[0057]the time of a luminescence setup of the internal flash 5 (it is Yes at step ST21) -- then, only the exposure time to which CCD303 was set without emitting light in the internal flash 5 is exposed, and the image of a photographic subject is captured as a non-flash image. After exposure, predetermined processing is performed in the signal conditioning circuit 313, A-D converter 205, and the 1st image processing portion 240, and the picture signal outputted from CCD303 is memorized by the image memory 209. Since this non-flash image is a picture photoed without emitting light in the internal flash 5, it turns into a comparatively low picture of brightness (step ST22).

[0058]Next, light is emitted (step ST23), only the exposure time to which CCD303 was set exposes the internal flash 5, and the image of the same photographic subject as the above-mentioned non-flash image is captured as a flash image. After exposure, predetermined processing is performed in the signal conditioning circuit 313, A-D converter 205, and the 1st image processing portion 240, and the picture signal outputted from CCD303 is memorized like the image memory 209. This flash image emitted light, was photoed, comes out of the internal flash 5, and, for a certain reason, turns into a picture whose brightness is comparatively high (appropriate exposure) (step ST24).

[0059]Drawing 10 is a figure showing an example of a non-flash image, and drawing 11 is a figure showing an example of a flash image to the same photographic subject as drawing 10. As shown in these figures, the non-flash image P1 turns into a dark picture as compared with the flash image P2.

[0060]In the picture P1 and P2, two person PS1, PS2, and building PS3 that have a color approximated beige are contained as a photographic subject. Person PS1 puts on the red accessories R1, and the clothes of person PS2 have the red button R2. The red illumination light source R3 exists in building PS3. The bloodshot-eyes phenomenon has occurred in the eye area E1 of person PS1 in the flash image of drawing 11, and PS2, and E2.

[0061]Next, the bloodshot-eyes detecting element 281 performs bloodshot-eyes detection processing which detects the bloodshot-eyes field in a flash image using the picture of two sheets memorized by the image memory 209 as mentioned above (step ST25).

[0062]Drawing 12 is a figure showing the flow of the bloodshot-eyes detection processing of the bloodshot-eyes detecting element 281. First, the incidence rate calculation part 291 computes the bloodshot-eyes incidence P (step ST101). The bloodshot-eyes incidence P is computable by the following several 1 using the luminance difference Brd and the predetermined constant A of the object distance D, a flash image, and a non-flash image.

[0063]

[Mathematical formula 1]

$$P = 1/D \times Brd \times A$$

[0064]Here, the object distance D is computed by the distance operation part 284. The luminance difference Brd is the difference of brightness Br2 of a flash image, and brightness Br1 of a non-flash image, and brightness Br1 and Br2 use the average of the RGB value of the picture element data in a picture. Brightness Br1 and Br2 may be changed into the average of only the value of G, and YCrCb, and they may use the average of the value of Y, etc. In calculation of the luminance difference Brd, it may be computed based on the emission quantity of the internal flash 5.

[0065]Next, according to the bloodshot-eyes incidence P, a change setup of the criterion for the criterion changing part 292 to judge as a bloodshot-eyes candidate

area is carried out as a pretreatment which extracts the bloodshot-eyes candidate area of a flash image and a non-flash image (step ST102).
[0066]Since there is a difference of brightness in a flash image and a non-flash image in this embodiment, A bloodshot-eyes candidate area is judged [chromaticity u' which is not affected from the RGB value of picture element data by the influence of brightness, and] by whether v' is computed and chromaticity u' and v' are in the specified region of a "CIE 1976 UCS chromaticity diagram." Chromaticity u' and v' are computable by following several 2 and several 3.
[0067]
[Mathematical formula 2]

$$u' = \frac{11.0756R + 7.0068G + 4.5208B}{17.7719R + 70.7817G + 18.8131B}$$

[0068]
[Mathematical formula 3]

$$v' = \frac{9.0018R + 41.3163G + 0.5400B}{17.7719R + 70.7817G + 18.8131B}$$

[0069]Drawing 13 is a simplified diagram of a "CIE 1976 UCS chromaticity diagram." The point shown by numerals RP in drawing 13 shows the red reference point used as the red of the ideal at the time of the bloodshot-eyes phenomenon beforehand set up by Measurement Division etc. The square area which gave the width of Lv in Lu, plus, and the direction of minus v', respectively is shown in plus and the direction of minus u' as the red criterion field RA from red reference point RP. If chromaticity u' of picture element data and v' are in the above-mentioned red criterion field RA, it will judge with the picture element data concerned being a bloodshot-eyes candidate area. That is, if the size (area) of the red criterion field RA is changed, the criterion for extracting a bloodshot-eyes candidate area will be changed.
[0070]Here, the area of the red criterion field RA is computable by the multiplication of the duplex of Lu, and the duplex of Lv. And the width Lu of the red criterion field RA and Lv are set up like following several 4 and several 5 based on initial value Lu0, Lv0, and the bloodshot-eyes incidence P which were set up beforehand.
[0071]
[Mathematical formula 4]

$$Lu = Lu0 / P$$

[0072]
[Mathematical formula 5]

$$Lv = Lv0 / P$$

[0073]Thereby, the size of the red criterion field RA can be widely set up, so that the size of the red criterion field RA is so narrow that the bloodshot-eyes incidence P is high and the bloodshot-eyes incidence P is low. That is, since the size of the red criterion field RA is changed according to the bloodshot-eyes incidence P, only the high field of probability can be extracted as a bloodshot-eyes candidate area as a bloodshot-eyes field.
[0074]Then, the candidate area extraction part 293 judges [chromaticity u' of each picture element data, and] whether V' is contained in the red criterion field RA as mentioned above, and extracts the bloodshot-eyes candidate area in a flash image (step ST103). When one is not extracted for a bloodshot-eyes candidate area in a flash image at this time (it is No at step ST104), it is judged that he has no bloodshot-eyes field (step ST109).
[0075]On the other hand, when at least one bloodshot-eyes candidate area is extracted in a flash image (it is Yes at step ST104), the bloodshot-eyes candidate area in a non-flash image is extracted in a similar manner (step ST105).
[0076]Drawing 14 is a figure showing the extracted bloodshot-eyes candidate area in the non-flash image P1 of drawing 10, and drawing 15 is a figure showing the

extracted bloodshot-eyes candidate area in the flash image P2 of drawing 11. In the non-flash image P1, as shown in drawing 14, the accessories R1, the button R2, and the illumination light source R3 are extracted as a bloodshot-eyes candidate area. On the other hand, in the flash image P2, as shown in drawing 15, in addition to the accessories R1, the button R2, and the illumination light source R3, the eye area E1 of person PS1 and PS2 and E2 are extracted as a bloodshot-eyes candidate area. That is, the bloodshot-eyes field is extracted as a bloodshot-eyes candidate area only in the flash image P2.

[0077]Next, the candidate area comparing element 294 compares the bloodshot-eyes candidate area extracted in a non-flash image and each flash image (step ST106). And when the bloodshot-eyes candidate area which exists only in a flash image exists (it is Yes at step ST107), the bloodshot-eyes candidate area concerned in a flash image is detected as a bloodshot-eyes field (step ST108). This is because the bloodshot-eyes phenomenon can judge the bloodshot-eyes candidate area which is only in a flash image since it generates only when light is emitted in the internal flash 5 to be a bloodshot-eyes field. Thereby, other bloodshot-eyes candidate areas are not detected as a bloodshot-eyes field, and can detect only a bloodshot-eyes field certainly.

[0078]Drawing 16 shows the field detected as a bloodshot-eyes field by comparing the non-flash image P1 (refer to drawing 14) and the flash image P2 (refer to drawing 15). As shown in a figure, only a person's eye area E1 and E2 are detected as a bloodshot-eyes field.

[0079]When the bloodshot-eyes candidate area which exists only in a flash image does not exist (it is No at step ST107), it is judged that he has no bloodshot-eyes field (step ST109).

[0080]If the bloodshot-eyes field in a flash image is detected as mentioned above next, the person detection part 282 will extract the beige field in a flash image, in order to detect a figure area (drawing 9, step ST26). It is judged whether extraction of the beige field is included like extraction of a bloodshot-eyes candidate area in chromaticity u' of the picture element data in a flash image, and the field where it was set up beforehand for v' to judge as the person of a "CIE 1976 UCS chromaticity diagram" being beige.

[0081]At this time, only the beige field near the bloodshot-eyes field is extracted by judging the above-mentioned beige field from the picture element data near the above-mentioned bloodshot-eyes field. And the extracted beige field is detected as a figure area. It is because it can judge that the beige field near the bloodshot-eyes field is a figure area (face area) since a bloodshot-eyes field is certainly included to the field of a person's face as for this. Buildings which have a color which this approximates beige are not extracted as a beige field, and can extract only the beige field which turns into a figure area certainly. It is necessary to judge a beige field to no picture element data in a flash image, and processing speed can be raised.

[0082]Drawing 17 shows the field detected as a figure area in the flash image P2 (drawing 15). As shown in a figure, only the bloodshot-eyes field E1 and the about [E2] beige field are detected as figure area PA, and building PS3 which has a color approximated beige is not detected as figure area PA.

[0083]In the above-mentioned bloodshot-eyes detection processing, when it is judged that he has no bloodshot-eyes field (drawing 12, step ST109), it considers that there is no person into a picture, and detection of a figure area is not performed.

[0084]Next, based on the information on the detected figure area and a bloodshot-eyes field, the image processing control part 273 sets up the image processing condition by the 2nd image processing portion 283. And the 2nd image processing portion 283 performs Image Processing Division to a flash image based on the set-up conditions. Thereby, Image Processing Division based on a figure area and a bloodshot-eyes field can be performed to a flash image (step ST27).

[0085]For example, the processing which adjusts brightness and saturation the optimal only to a figure area (face area) since the figure area is pinpointed, The processing etc. which make fields other than a figure area fade, and emphasize only

a person beautifully make the contents of processing different in a figure area and fields other than a figure area, and can perform Image Processing Division. Since the bloodshot-eyes field is pinpointed, bloodshot-eyes amendment processing in which a bloodshot-eyes field is replaced by colors, such as gray, can be performed easily. Photographing scenes, such as "scenery" and a "portrait", are judged and it also becomes possible from the number of figure areas to perform Image Processing Division according to a photographing scene.

[0086]The compressed picture and thumbnail picture are generated by the image recording section 274, and the flash image in which Image Processing Division was performed is memorized by the memory card 91 with tag information by it (step ST28).

[0087]. [at by the way, the time of a nonluminescent setup of the internal flash 5 (it is No at step ST21)] Since the picture of appropriate exposure is acquirable even if it does not emit light in the internal flash 5, the image of a photographic subject is captured without using the internal flash 5, predetermined processing is performed, and the image memory 209 memorizes (step ST31). Since a bloodshot-eyes phenomenon is not generated in the picture captured at this time, bloodshot-eyes detection processing is not performed, but a beige field is extracted regardless of a bloodshot-eyes field, and this beige field is detected as a figure area (step ST32). And Image Processing Division based on the figure area detected like step ST27 is performed (step ST33). Since a bloodshot-eyes phenomenon is not generated, bloodshot-eyes amendment processing is not performed. When Image Processing Division is performed, the memory card 91 will memorize like the above (step ST28).

[0088]In this embodiment, although luminescence and a nonluminescent setup of the internal flash 5 were automatically made based on the brightness of a photographic subject, these can be set up by a user.

[0089]As mentioned above, although a 1st embodiment was described, In this embodiment, since it is what is generated only when a bloodshot-eyes phenomenon emits light in a flash using a non-flash image and a flash image and the bloodshot-eyes candidate area only in a flash image is detected as a bloodshot-eyes field, it becomes possible to detect a bloodshot-eyes field certainly.

[0090]Since the beige field near the detected bloodshot-eyes field is detected as a figure area, only a figure area is certainly detectable. At comparatively high speed, since it is not necessary to perform complicated processing of a shape judging of a beige field, etc., a figure area can be detected.

[0091]Since the conditions of Image Processing Division are set up based on a figure area, the contents of processing are made different in a figure area and fields other than a figure area, Image Processing Division can be performed, and the optimal Image Processing Division for a figure area can be performed. Since the bloodshot-eyes field is pinpointed, bloodshot-eyes amendment processing can be performed easily.

[0092]<2. a 2nd embodiment>, next a 2nd embodiment of this invention are described. In a 1st embodiment, although the figure area was detected and the image processing condition was set up based on the figure area concerned, by this embodiment, image pick-up conditions are further set up based on a figure area. The digital cameras 1 which are the image processing devices in this embodiment are the composition shown in drawing 1 thru/or drawing 5, and the same composition.

[0093]Drawing 18 is a block diagram showing the function of the digital camera 1 concerning the person detection processing in this embodiment. The functional constitution of the bloodshot-eyes detecting element 281 is the same as the composition shown in drawing 7. About what has the same function as a 1st embodiment, since the same numerals are attached, detailed explanation is omitted. In drawing 18, the bloodshot-eyes development judgment part 285 shows the function realized when operation processing is carried out by CPU of the whole control part 270, etc. according to the control program memorized by ROM261. The bloodshot-eyes development judgment part 285 judges whether a bloodshot-eyes phenomenon occurs from the brightness of a photographic subject, and object

distance before photographing operation. The details of the function of the bloodshot-eyes development judgment part 285 are mentioned later.
[0094]Drawing 19 thru/or drawing 21 are the figures showing the flow of the operation at the time of photography of the digital camera 1 in the person detection mode of this embodiment. Hereafter, with reference to drawing 18 thru/or drawing 21, the photographing operation in the person detection mode of the digital camera 1 in this embodiment is explained.
[0095]first, the shutter button 8 half-presses (S1 state) -- having (step ST51). The bloodshot-eyes development judgment part 285 computes photographic subject brightness Br from the picture signal inputted from A-D converter 205, Based on the object distance D inputted from computed photographic subject brightness Br and the distance operation part 284, when light is emitted in the internal flash 5, bloodshot-eyes development judging processing in which it is judged whether a bloodshot-eyes phenomenon occurs is performed (step ST52).
[0096]Drawing 22 is a figure showing the judgment function used for bloodshot-eyes development judging processing. In the figure, a horizontal axis shows photographic subject brightness Br, and the vertical axis shows the object distance D. The field shown by numerals FA will be a bloodshot-eyes development field which a bloodshot-eyes phenomenon generates, if light is emitted in the internal flash 5, and fields other than bloodshot-eyes development field FA are fields which a bloodshot-eyes phenomenon does not generate even if it emits light in the internal flash 5. This bloodshot-eyes development field FA is beforehand set up by Measurement Division etc. It will judge with a bloodshot-eyes phenomenon generating the bloodshot-eyes development judgment part 285, if the point determined by photographic subject brightness Br and the object distance D is in bloodshot-eyes development field FA.
[0097]When judged with a bloodshot-eyes phenomenon occurring (it is Yes in step ST52), it progresses to step ST53. The processing in Steps ST53-ST57 is the same as processing of Steps ST22-ST26 of drawing 9. Namely, a non-flash image and a flash image are taken in (Steps ST53-ST55), The bloodshot-eyes detection processing which uses both images detects a bloodshot-eyes field (step ST56), the beige field near this bloodshot-eyes field is extracted, and this beige field is detected as a figure area (step ST57).
[0098]On the other hand, when judged with a bloodshot-eyes phenomenon not occurring (it is No in step ST52), it progresses to step ST58. The processing in step ST58 and ST59 is the same as that of step ST31 of drawing 9, and ST32. That is, the image of a photographic subject is captured, without using the internal flash 5 (step ST31), a beige field is extracted, without performing bloodshot-eyes detection processing, and this beige field is detected as a figure area (step ST59).
[0099]Next, the person detection part 282 sets up the control domain surrounding the figure area detected as mentioned above (drawing 20, step ST61). Drawing 23 is a figure showing an example of set-up control domain CA. As shown in a figure, the square area of the minimum area surrounding figure area PA from which control domain CA was detected is set up.
[0100]Control domain CA is used as a field for calculating the brightness of a photographic subject, contrast, color balance, etc. in subsequent processings. That is, based on control domain CA including a figure area, a setup of image pick-up conditions including an exposure condition and image processing conditions, such as a white balance adjustment value, will be made.
[0101]A setup of control domain CA will display field CA1 equivalent to control domain CA on EVF31 like drawing 24 (step ST62). Field CA1 is displayed on the same screen as the object image by which it is indicated by the live view as shown in drawing 24. A user can be made by this to be able to check the field used for a setup of image pick-up conditions or an image processing condition, and sense of security can be given to a user. The same display as EVF31 is made also in LCD10.
[0102]Next, the AF control part 271 performs AF control based on control domain CA, and drives the focus lens 311 (step ST63). The contrast of only the field which

is specifically equivalent to control domain CA among the picture signals inputted from A-D converter 205 is evaluated, and the position of the focus lens 311 is made to drive so that this contrast may become the highest. It can change into the state where the figure area used as a main object was focused most by this.
[0103]Next, the exposure controller 272 sets up an exposure condition based on control domain CA. A setup of a (nonluminescent setup) is made [whether it is emitting light in an iris diaphragm value, shutter speed, and the internal flash 5 (luminescence setup), and] based on the brightness of only the field which is specifically equivalent to control domain CA among the picture signals inputted from A-D converter 205 (step ST64).
[0104]Next, the image processing control part 273 sets up a white balance adjustment value based on control domain CA. A setup of a white balance adjustment value is made based on the color balance of only the field which is specifically equivalent to control domain CA among the picture signals inputted from A-D converter 205 (step ST65).
[0105]Termination of a setup of the image pick-up conditions and image processing condition based on control domain CA as mentioned above will make release permission (step ST66). When predetermined time operation of the shutter button 8 is not carried out in this state (it is No at step ST67), it will return to step ST11 of drawing 19.
[0106]On the other hand, when the shutter button 8 is pressed fully (it is Yes at step ST67), it progresses to step ST71 of drawing 21. And at the time of a luminescence setup of the internal flash 5 (it is Yes at step ST71), the internal flash 5 emits light and an image shot (step ST72) is taken in (step ST73). On the other hand, an image shot is taken in, without emitting light in the internal flash 5 at the time of a nonluminescent setup of the internal flash 5 (it is No at step ST71) (step ST73). Since the exposure condition at the time of taking in of an image shot is set up based on control domain CA, it can be made into correct exposure to the figure area used as a main object.
[0107]Even if it is a case where light is emitted in the internal flash 5, a bloodshot-eyes phenomenon is not generated for the photographic subject in an image shot. When judged with a bloodshot-eyes phenomenon generating this, it is for the internal flash 5 to emit light in step ST54 of drawing 19, and for this luminescence to function as Puri luminescence of bloodshot-eyes phenomenon prevention.
[0108]Next, Image Processing Division in which predetermined processing is performed in the signal conditioning circuit 313 and A-D converter 205, and also the taken-in image shot includes white-balance-correction processing in the 1st image processing portion 240 is performed (step ST74). Since the white balance adjustment value is set up based on control domain CA at this time, Image Processing Division is performed so that the figure area used as a main object may serve as suitable white balance.
[0109]The image shot in which Image Processing Division was performed by the 1st image processing portion 240 is memorized by the image memory 209. At this time, the 2nd image processing portion 283 is able to perform Image Processing Division from which the contents of processing are made different [in a figure area and fields other than a figure area] like a 1st embodiment to the image shot memorized by the image memory 209.
[0110]The compressed picture and thumbnail picture are generated by the image recording section 274, and the image shot in which Image Processing Division was performed is memorized by the memory card 91 with tag information by it (step ST75).
[0111]As mentioned above, in this embodiment, although a 2nd embodiment was described, since a setup of image pick-up conditions or an image processing condition is made based on control domain CA including the detected figure area, the picture photoed by the optimal control for the figure area used as a main object is acquirable.
[0112]<3. a 3rd embodiment>, next a 3rd embodiment of this invention are described. In a 1st embodiment, although detection of a bloodshot-eyes field and detection of the figure area were performed in digital camera 1 inside, processings

other than acquisition of such a picture may be performed by the computer.
[0113]Drawing 25 is a figure showing the composition of the image processing system 7 in such a case. The image processing system 7 has the digital camera 71 which acquires a non-flash image and a flash image, and the computer 72 which processes the picture obtained with the digital camera 71.
[0114]The thing of the same composition as the digital camera 1 of the above-mentioned embodiment can be used for the digital camera 71. The digital camera 71 performs processing of Steps ST11-ST16, ST21-ST24, and ST28 among the processings shown in drawing 8 and drawing 9. That is, a non-flash image and a flash image are photoed and both images are saved as it is at a memory card, without performing bloodshot-eyes detection processing, person detection processing, and Image Processing Division based on a figure area. That information which is any of a non-flash image and a flash image at least, and the information on object distance are made to be included in the tag information generated at the time of memory card preservation.
[0115]The non-flash image and flash image which were acquired with the digital camera 71 are transmitted to the computer 72 via a memory card. It transmits to the computer 72 via a transmission cable etc.
[0116]The computer 72 comprises a general-purpose computer provided with CPU, ROM, RAM, a storage apparatus, a display, a memory card reader, etc. The program is beforehand installed in the computer 72 inside via the recording media 73, such as a magnetic disk, an optical disc, and a magneto-optical disc. Thereby, the general-purpose computer 72 becomes possible [using as an image processing device which performs processing concerning this invention].
[0117]Namely, by operating as the bloodshot-eyes detecting element 281 which CPU of the computer 72, etc. show to drawing 6, the person detection part 282, the image processing control part 273, and the 2nd image processing portion 283, [flash image / a non-flash image and] The bloodshot-eyes field in a flash image is detected, and a figure area is detected based on the bloodshot-eyes field concerned. Based on the detected figure area, the 2nd image processing portion 283 performs Image Processing Division from which the contents of processing are made different in a figure area and fields other than a figure area.
[0118]If it is made above, bloodshot-eyes detection processing, person detection processing, and Image Processing Division based on a figure area can also be carried out by computer 72, and the burden of the processing in the digital camera 71 will be sharply eased in this case.
[0119]Although beyond <4. modification> described the embodiment of the invention, this invention is not limited to the above-mentioned embodiment.
[0120]For example, the circuit of exclusive use [some or all of the functions realized by the software processing by the whole control part 270 of the digital camera 1 of 1st and 2nd embodiments of the above] may be realized. It may realize by the software processing according all to the whole control part 270 in part conversely among the functions realized by the circuit of the 1st image processing portion 240 grade of the digital camera 1 for exclusive use.
[0121]moreover -- picture element data -- chromaticity -- u -- ' -- v -- ' -- using -- bloodshot eyes -- a candidate area -- judging -- **** -- although -- an XYZ color coordinate -- it can set -- chromaticity -- HLS -- a color system -- it can set -- a hue -- saturation -- etc. -- chromaticity -- u -- ' -- v -- ' -- except -- a value -- bloodshot eyes -- a candidate area -- a judgment -- it may use . Also in this case, the criterion in the color system to be used is set up beforehand, and if the criterion concerned is changed according to the bloodshot-eyes incidence P, only the high field of probability can be extracted as a bloodshot-eyes candidate area as a bloodshot-eyes field.
[0122]The shape of the red criterion field RA is not what it explained for being a square area, but is limited to this, For example, it may have the shape of elliptical [which gave the width of Lv in plus and the direction of minus u' in Lu, plus, and the direction of minus v' from red reference point RP, respectively], etc. They may be u' and the straight line which did not need to give width to the both directions of v' and gave only either width.

[0123]In a 2nd embodiment of the above, although control domain CA of the rectangle surrounding a figure area was set up, a figure area may be used as a control domain as it is. Thus, it becomes possible to acquire the picture further photoed by optimal control by making a figure area into a control domain as it is according to the figure area.

[0124]

[Effect of the Invention]As mentioned above, as explained, according to the invention of Claims 1-6, the detection probability of the bloodshot-eyes field in the 2nd picture improves by using the 1st picture photoed without emitting light in a flash, and the 2nd picture photoed by emitting light in the flash. After detecting a bloodshot-eyes field, in order to detect a figure area, while only a figure area is detectable, complicated processing of a shape judging etc. can be unnecessary and can raise processing speed.

[0125]According to the invention of Claim 2, since a bloodshot-eyes phenomenon is what is generated only when light is emitted in a flash, it can detect a bloodshot-eyes field easily and certainly by detecting the bloodshot-eyes candidate area only in the 2nd picture at the time of flash luminescence as a bloodshot-eyes field.

[0126]According to the invention of Claim 3, since a criterion is changed according to the bloodshot-eyes incidence, only the high field of probability is detectable as a bloodshot-eyes candidate area as a bloodshot-eyes field.

[0127]According to the invention of Claim 4, since the conditions of Image Processing Division are set up based on a figure area, the contents of processing are made different in a figure area and fields other than a figure area, Image Processing Division can be performed, and the optimal Image Processing Division for a figure area can be performed. Since image pick-up conditions can be set up according to a figure area, optimal photography can be performed according to a figure area.

[Brief Description of the Drawings]

[Drawing 1]It is a front view of the digital camera which is an image processing device concerning this invention.

[Drawing 2]It is a rear elevation of a digital camera.

[Drawing 3]It is a bottom view of a digital camera.

[Drawing 4]It is a figure showing the outline of arrangement of each composition in an image pick-up part.

[Drawing 5]It is a block diagram showing the composition of a digital camera.

[Drawing 6]It is a block diagram showing the function of the digital camera concerning the person detection processing in a 1st embodiment.

[Drawing 7]It is a block diagram showing the functional constitution of a bloodshot-eyes detecting element.

[Drawing 8]It is a figure showing the flow of the operation at the time of photography of the digital camera in the person detection mode in a 1st embodiment.

[Drawing 9]It is a figure showing the flow of the operation at the time of photography of the digital camera in the person detection mode in a 1st embodiment.

[Drawing 10]It is a figure showing an example of a non-flash image.

[Drawing 11]It is a figure showing an example of a flash image.

[Drawing 12]It is a figure showing the flow of the bloodshot-eyes detection processing of a bloodshot-eyes detecting element.

[Drawing 13]It is a simplified diagram of a CIE 1976 UCS chromaticity diagram.

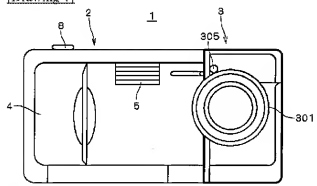
[Drawing 14]It is a figure showing the extracted bloodshot-eyes candidate area in a non-flash image.

[Drawing 15]It is a figure showing the extracted bloodshot-eyes candidate area in a flash image.

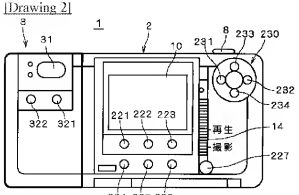
[Drawing 16]It is a figure showing the field detected as a bloodshot-eyes field in a

flash image.
[Drawing 17]It is a figure showing the field detected as a figure area in a flash image.
[Drawing 18]It is a block diagram showing the function of the digital camera concerning the person detection processing in a 2nd embodiment.
[Drawing 19]It is a figure showing the flow of the operation at the time of photography of the digital camera in the person detection mode in a 2nd embodiment.
[Drawing 20]It is a figure showing the flow of the operation at the time of photography of the digital camera in the person detection mode in a 2nd embodiment.
[Drawing 21]It is a figure showing the flow of the operation at the time of photography of the digital camera in the person detection mode in a 2nd embodiment.
[Drawing 22]It is a figure showing the judgment function used for bloodshot-eyes development judging processing.
[Drawing 23]It is a figure showing an example of a control domain.
[Drawing 24]It is a figure showing an example of a display of EVF.
[Drawing 25]It is a figure showing the composition of an image processing system.
[Explanations of letters or numerals]
1 Digital camera
5 Internal flash
7 Image processing system
91 Memory card
270 Whole control part
281 Bloodshot-eyes detecting element
282 Person detection part
301 Zoom lens
302 Iris diaphragm
304 Light control circuit
322 Person detection mode change button

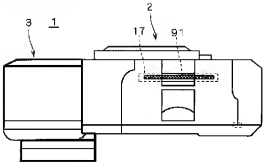
[Drawing 1]



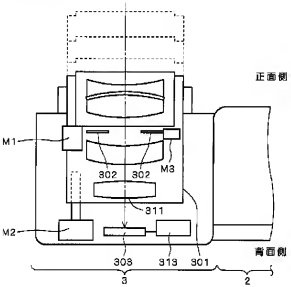
[Drawing 2]



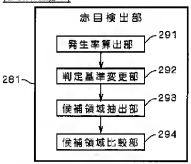
[Drawing 3]



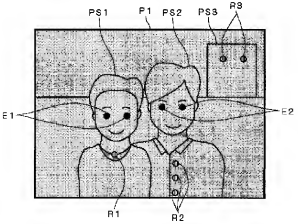
[Drawing 4]



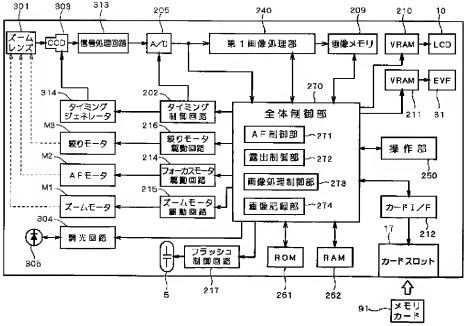
[Drawing 7]



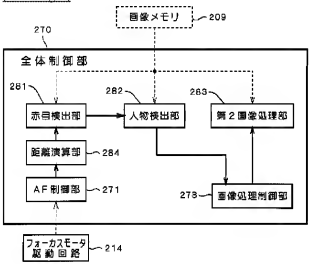
[Drawing 10]



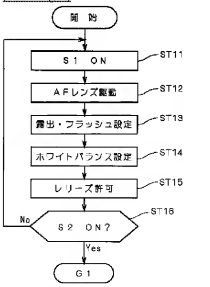
[Drawing 5]



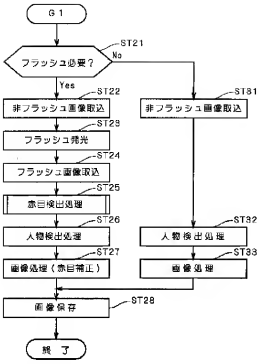
[Drawing 6]



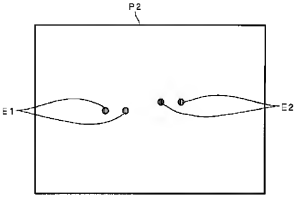
[Drawing 8]



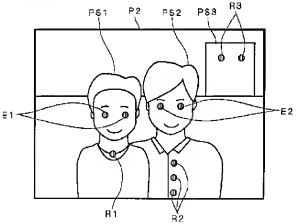
[Drawing 9]



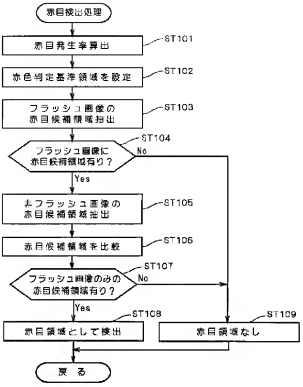
[Drawing 16]



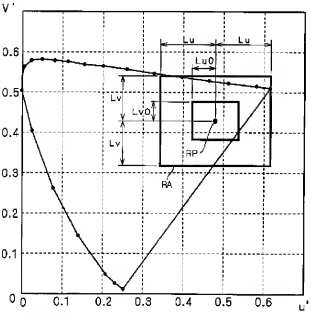
[Drawing 11]



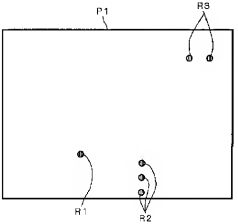
[Drawing 12]



[Drawing 13]



[Drawing 14]



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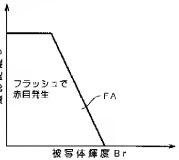
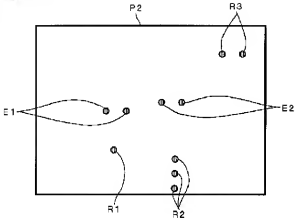


[Drawing 15]



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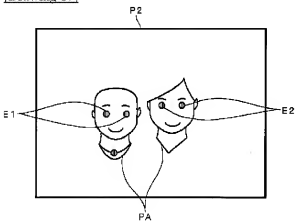

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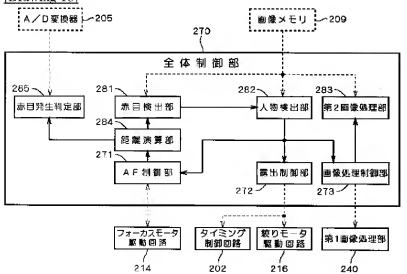

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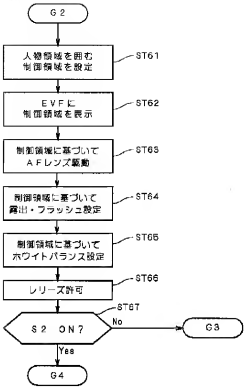

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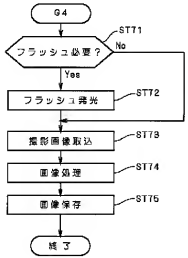

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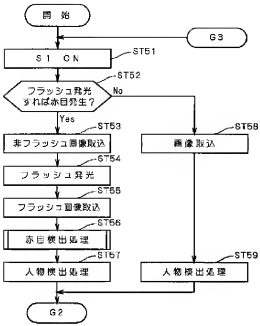

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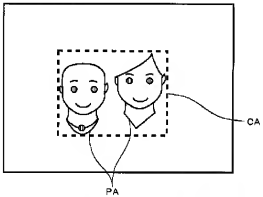

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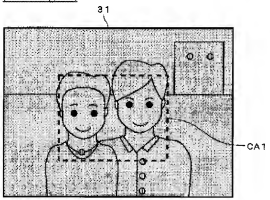
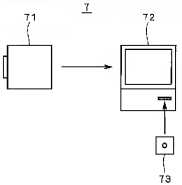


[Drawing 25]



[Translation done.]

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